

Amendments to the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1.-11. (Cancelled)

12. (New) A method for encoding a digital still image to produce a compressed bit stream, said method comprising the steps of:

- a) decomposing and ordering the digital still image into a hierarchy of multi-resolution images, wherein each multi-resolution image comprises a set of one or more transform coefficients, wherein each transform coefficient has a magnitude and wherein each transform coefficient represents a pixel of said digital still image;
- b) initializing a list of insignificant blocks, a temporary list of insignificant blocks and a list of significant pixels as empty sets, wherein after initialization and during processing the list of insignificant blocks is used to store one or more blocks of transform coefficients for which all transform coefficients are insignificant for a particular threshold value or have not yet been evaluated for significance, the temporary list of insignificant blocks is used to store one or more blocks of transform coefficients for which all transform coefficients have been evaluated to be insignificant for a particular threshold value and the list of significant pixels comprises one or more transform coefficients which have been evaluated to be significant for a particular threshold value;
- c) entering each multi-resolution image as a block of transform coefficients into the list of insignificant blocks in an arbitrary sequence;
- d) determining an initial threshold value based on the transform coefficient having the largest magnitude;
- e) generating a significance map related to a selected threshold value and encoding said significance map using a quadtree representation, wherein said significance map is determined by the evaluation of the significance of the blocks of transform coefficients within the list of insignificant blocks in relation to this selected threshold value, wherein the sequence of evaluation is performed

according to the sequence in which the blocks of transform coefficients were entered into the list of insignificant blocks and wherein a transform coefficient greater than or equal to the selected threshold value is significant in relation to this selected threshold value; and

f) generating the compressed bit stream, wherein said bit stream contains a bit stream header comprising information relating to method of generation of said compressed bit stream.

13. (New) The method defined in claim 12, wherein said determining of a significance map comprises the steps of:

- 1) evaluating a block of transform coefficients contained in the list of insignificant blocks, wherein blocks of transform coefficients are evaluated in the sequence which they are initially entered into the list of insignificant blocks;
- 2) comparing the magnitude of each transform coefficient of said block with the selected threshold value to determine if said block of transform coefficients is significant, wherein a block containing only insignificant transform coefficients is transferred to the temporary list of insignificant blocks;
- 3) transferring said block of transform coefficients to the list of significant pixels when said block of transform coefficients comprises one significant transform coefficient;
- 4) otherwise subdividing said block of transform coefficients into sub-blocks of transform coefficients and entering these sub-blocks into the list of insignificant blocks, if said block of transform coefficients contains at least one significant transform coefficient;
- 5) sequentially repeating steps 1) to 4) for each block of transform coefficients within the list of insignificant blocks until said list of insignificant blocks is empty;
- 6) generating output bits using the list of significant pixels;
- 7) arranging the blocks of transform coefficients contained in the temporary list of insignificant blocks based on specified criteria;
- 8) replacing the list of insignificant blocks with the temporary list of insignificant blocks; and

9) decreasing the selected threshold value by a predetermined value and generating a significance map for this new selected threshold value; wherein said selected threshold value is sequentially decreased to a predetermined level.

14. (New) The method defined in claim 12, wherein a refinement bit for each transform coefficient in the list of significant pixels for a particular specified threshold value is determined and incorporated in the bit stream after the significance map for the particular specified threshold value, wherein a refinement bit is a predetermined bit of the transform coefficient.

15. (New) The method defined in claim 12, wherein the decomposing and ordering of the digital still image into a hierarchy of multi-resolution sub-images is performed using a wavelet transformation.

16. (New) The method defined in claim 12, further comprising the step of implementing a multiplexing protocol that assembles compressed data from different regions and resolution channels into an integrated bit-stream enabling both an encoder and a decoder to selectively and interactively control a bit budget and the quality of the compressed images.

17. (New) An apparatus for encoding a digital still image that produces a compressed bit stream, said apparatus comprising:

a) means for decomposing and ordering the digital still image into a hierarchy of multi-resolution images, wherein each multi-resolution image comprises a set of one or more transform coefficients, wherein each transform coefficient has a magnitude and wherein each transform coefficient represents a pixel of said digital still image;

b) means for initializing a list of insignificant blocks, a temporary list of insignificant blocks and a list of significant pixels as empty sets, wherein after initialization and during processing the list of insignificant blocks is used to store one or more blocks of transform coefficients for which all transform coefficients

are insignificant for a particular threshold value or have not yet been evaluated for significance, the temporary list of insignificant blocks is used to store one or more blocks of transform coefficients for which all transform coefficients have been evaluated to be insignificant for a particular threshold value and the list of significant pixels comprises one or more transform coefficients which have been evaluated to be significant for a particular threshold value;

c) means for entering each multi-resolution image as a block of transform coefficients into the list of insignificant blocks in an arbitrary sequence;

d) means for determining an initial threshold value based on the transform coefficient having the largest magnitude;

e) means for generating a significance map related to a selected threshold value and encoding said significance map using a quadtree representation, wherein said significance map is determined by the evaluation of the significance of the blocks of transform coefficients within the list of insignificant blocks in relation to this selected threshold value, wherein the sequence of evaluation is performed according to the sequence in which the blocks of transform coefficients were entered into the list of insignificant blocks and wherein a transform coefficient greater than or equal to the selected threshold value is significant in relation to this selected threshold value; and

f) means for generating the compressed bit stream, wherein said bit stream contains a bit stream header comprising information relating to the method of generation of said compressed bit stream.

18. (New) The apparatus defined in claim 17, wherein said means for determining a significance map comprises:

1) means for evaluating a block of transform coefficients contained in the list of insignificant blocks, wherein blocks of transform coefficients are evaluated in the sequence which they are initially entered into the list of insignificant blocks;

2) means for comparing the magnitude of each transform coefficient of said block with the selected threshold value to determine if said block of transform coefficients is significant, wherein a block containing only insignificant transform coefficients is transferred to the temporary list of insignificant blocks;

- 3) means for transferring said block of transform coefficients to the list of significant pixels when said block of transform coefficients comprises one significant transform coefficient;
- 4) means for otherwise subdividing said block of transform coefficients into sub-blocks of transform coefficients and entering these sub-blocks into the list of insignificant blocks, if said set of transform coefficients contains at least one significant transform coefficient;
- 5) means for sequentially repeating the steps performed by means 1) to 4) for each block of transform coefficients within the list of insignificant blocks until said list of insignificant blocks is empty;
- 6) means for generating output bits using the list of significant pixels;
- 7) means for arranging the sets of transform coefficients contained in the temporary list of insignificant blocks based on specified criteria;
- 8) means for replacing the list of insignificant blocks with the temporary list of insignificant blocks; and
- 9) means for decreasing the selected threshold value by a predetermined value and generating a significance map for this new selected threshold value;

wherein said selected threshold value is sequentially decreased to a predetermined level.

19. (New) The apparatus defined in claim 17, wherein a refinement bit for each transform coefficient in the list of significant pixels for a particular specified threshold value is determined and incorporated in the bit stream after the significance map for the particular specified threshold value, wherein a refinement bit is a predetermined bit of the transform coefficient.

20. (New) The apparatus defined in claim 17, wherein the means for decomposing and ordering the digital still image into a hierarchy of multi-resolution sub-images uses a wavelet transformation.

21. (New) The apparatus defined in claim 17, further comprising a multiplexing means that assembles compressed data from different regions and resolution channels

into an integrated bit-stream enabling both an encoder and a decoder to selectively and interactively control a bit budget and the quality of the compressed images.

22. (New) A method for decoding a compressed bit stream to produce a digital still image, said method comprising the steps of:

- a) decoding a bit stream header associated with the compressed bit stream, wherein the bit stream header comprises information relating to the method of generation of said compressed bit stream;
- b) generating an initial list of insignificant blocks based on the decoded bit stream header;
- c) initializing an empty list of significant pixels;
- d) initializing a wavelet coefficient array based on the decoded bit stream header;
- e) generating a current threshold value based on the decoded bit stream header;
- f) decoding a quad-tree encoded significance map from the list of insignificant blocks based on the current threshold value;
- g) modifying the list of significant pixels and the list of insignificant blocks of pixels according to said decoding;
- h) decoding refinement bits of wavelet coefficients wherein the coefficients of all pixels moved to the list of significant pixels are updated based on said decoded refinement bits;
- i) reducing the current threshold and repeating steps f) to h) to obtain a further significance map using the reduced threshold value until all significance maps in the compressed bit stream have been generated;
- j) constructing said wavelet coefficient array based on said significance maps; and
- k) reconstructing the digital still image from said wavelet coefficient array using an inverse wavelet transform.

23. (New) The method according to claim 12, wherein the compressed bit stream is a compressed data file.

24. (New) The apparatus according to claim 17, wherein the compressed bit stream is a compressed data file.